Options for Using Poultry Litter as a Source of Energy

John H. Martin, Jr.
Hall Associates
Georgetown, Delaware

What are the possible options?

- Anaerobic digestion
- Gasification
- Direct Combustion

What is poultry litter?

The term litter, as used in the poultry industry, describes the mixture of manure and some bedding material, e.g. pine sawdust or rice hulls, which accumulates during broiler and turkey grow-out cycles.

What is the heating value of poultry litter?

- For broiler litter, reported values, on an as produced basis, range from 4,637 to 6,950 BTU/lb.
- On a moisture and ash free basis, reported values range from 7,787 to 9,000 BTU/lb.

Sources of variability in heating value:

- Moisture content—can range from less than 15% to over 30% depending on litter management practices.
- Ash content—can range from about 9% to over 25% depending on litter age.

What is the monetary value, on a BTU content basis, of poultry litter?

Value of poultry litter as a substitute for conventional fuels.

Fuel replaced	Litter value, $/ton
Coal at $35/ton	13.33
No. 2 distillate fuel oil @$0.97/gal.	64.03
Residual fuel oil, ≤ 1% sulfur @$ 0.69/gal	41.11
Propane @ $1.10/gal	110.88
Natural gas @ 6.64/10^6 Btu	61.26

Anaerobic Digestion

- The form of usable energy produced, biogas, is derived from the microbially mediated reduction of readily biodegradable forms of organic carbon.
- Much of the readily biodegradable organic carbon in poultry litter is lost during accumulation.

Anaerobic Digestion (continued)

- Anaerobic digestion of poultry litter would require the addition of a substantial amount of water to create a slurry. Therefore, the volume of material requiring ultimate disposal and the associated cost would be substantially increased.

Gasification

- Gasification is a form of pyrolysis or destructive distillation, which simply is a chemical change produced by heating.
- It is the process that was widely used for the production of a fuel gas from coal before natural gas become widely available.

Gasification (continued)

- For example, gasification with air will produce a low Btu gas whereas gasification with pure oxygen will produce a medium Btu gas that can be upgraded to methanation to a high Btu gas
- The composition and Btu content of the gas produced depends on the specific process utilized and the characteristics of the carbon source including particle size and moisture content.

Gasification (continued)

- Ash is a residual of all gasification processes (of which there are many) and disposal cost needs to be recognized as possibly significant.

Combustion Options

- Co-firing—Centralized (The DPL experience)
- Direct combustion—Centralized (FiberWatt) or on-farm

Specific problems with direct combustion:

- Slag formation
- Boiler tube fouling and corrosion

Factors to be considered in evaluating options:

- Simplicity of operation and reliability
- Potential for on-site use of the energy produced and the associated revenue realized
- Costs
  - Litter transportation
  - Ash disposal

There is no such thing as a free lunch!